

1           **IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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6   **Patent Application for:**

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8           **METHOD AND STRUCTURE FOR MESSAGE AND NOTE COMPOSITION**

9                           **ON SMALL SCREEN DEVICES**

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**METHOD AND SYSTEM FOR MESSAGE AND NOTE COMPOSITION ON**  
**SMALL SCREEN DEVICES**

**CROSS REFERENCE TO RELATED APPLICATIONS**

The present invention is related to U.S. Patent Application No. 09/901,878 (Attorney Docket No. LX00071) entitled "Handwriting User Interface for Personal Digital Assistants and the Like" to Seni et al., assigned to the assignee of the present invention, filed July 9, 2001 and published as US-2003-0007018-A1 on January 9, 2003; to U.S. Patent Application No. 09/938,319 (Attorney Docket No. CML00005H) entitled "Automatically Scrolling Handwritten Input User Interface for Personal Digital Assistants and the Like" to Demartines et al., assigned to the assignee of the present invention, filed August 22, 2001, and published as US-2003-0038788-A1; and U.S. Patent Application No. 09/909,202 (Attorney Docket No. CML00010H) entitled "Text Input Method for Personal Digital Assistants and the Like" to Nagel et al., assigned to the assignee of the present invention, filed July 19, 2001 and published as US-2003-0016873-A1 on January 23, 2003. These applications are herein incorporated by reference.

**TECHNICAL FIELD**

This invention relates to written message and note composition on small screen sized devices and more specifically to methods and systems for digital ink message and note composition on small screen sized devices, such as mobile devices or personal digital assistants ("PDAs").

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BACKGROUND OF THE INVENTION

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4           Small, touch-enabled, screen devices, such as mobile cellular  
5 telephones and personal digital assistants ("PDAs"), are increasing in  
6 popularity. A typical small, touch-enabled, screen device is a limited function  
7 microcomputer provided with a pressure sensitive liquid crystal diode (LCD)  
8 display (a touch pad or a touch screen) for input and output (I/O). Small  
9 screen devices are useful for many purposes including voice and wireless  
10 Internet communication, scheduling, and note taking. Often the primary input  
11 means for these small screen devices is via the pressure sensitive LCD  
12 display with a limited-size keypad.. As these portable devices become  
13 smaller and more specialized, continuous written input has become more  
14 difficult and less practical. Pen-based user interfaces are attractive because  
15 they are scalable (i.e., only small reductions in size can be made to keyboards  
16 before they become awkward to use) and offer the pointing capabilities of a  
17 touch-screen or mouse. Furthermore, when compared to voice-based  
18 interfaces, pen-based input takes place in private, in silence without disturbing  
19 bystanders, and is insensitive to acoustic noise in the environment.

20

21           Manual input on small screen devices, such as mobile cellular  
22 telephones and personal digital assistants ("PDA") generally consists of one

1 or more "ink traces" for user input. As is known in the art, an ink point is an  
2 element in the stream of data recorded by a real-time digitizer of writing and a  
3 trace is a sequence of contiguous ink points. An ink trace is a complete pen-  
4 down movement bounded by two pen-up movements or a complete pen-up  
5 movement. A sequence of traces accumulates to meaningful units, such as  
6 characters and words.

7

8       Because of the limited size of the screen relative to the size of the  
9 written input, there are inherent complications associated with the physical  
10 size of the input area on small screen devices. For small screen sized  
11 devices such as of PDAs, input interfaces often referred to as write-anywhere  
12 user interfaces allow users to write two or three lines at a time where each  
13 line may only contain two or three words. This limited word entry capability  
14 limits the realistic volume of writing and prevents continuous uninterrupted  
15 longhand entry. Further, these write-anywhere interfaces are problematic  
16 because it is difficult to differentiate whether the stylus is acting as a pointer,  
17 for clicking on application icons and the like, or an inking instrument for text  
18 entry. A common solution involves an un-natural "tap and hold" scheme  
19 wherein the pen has to be maintained down without dragging it for a certain  
20 amount of time in order to get the stylus to act temporarily as a mouse. This  
21 can lead to text input errors and the attendant aggravation and input delays  
22 caused by such errors.

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2           In the prior art there exists several options to increase the writing space  
3 available: the user can manually scroll the writing area, the application can  
4 automatically scroll up the writing area when ink traces are detected at the  
5 bottom of the screen, or the application can convert the ink traces into a  
6 scaled down representation that clears part of the writing area. Each of the  
7 current prior art options has problems associated with them that require  
8 interruptions in the writing input. Manually scrolling the input area requires  
9 the user to move the cursor away from the input area and to a scroll bar or  
10 equivalent movement area to manually scroll the writing area. Automatically  
11 scrolling by an application detecting ink traces at the bottom of the screen  
12 requires interruptions during the detection and scrolling process. Finally,  
13 automatically converting the ink traces into a scaled down representation  
14 requires interruptions during the conversion process since a portion of the  
15 writing area is cleared.

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1                    BRIEF DESCRIPTION OF THE DRAWINGS

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3            The features of the invention believed to be novel are set forth with  
4    particularity in the appended claims. The invention itself however, both as to  
5    organization and method of operation, together with objects and advantages  
6    thereof, may be best understood by reference to the following detailed  
7    description of the invention, which describes certain exemplary embodiments  
8    of the invention, taken in conjunction with the accompanying drawings in  
9    which:

10

11    **FIG. 1** is a first plan view of a handheld device in accordance with certain  
12    embodiments of the invention showing a graphical handwriting user interface  
13    having a continuously scrolling text screen area.

14

15    **FIG. 2** is a second plan view of a handheld device in accordance with certain  
16    embodiments of the invention showing a graphical handwriting user interface  
17    having a continuously scrolling handwritten text input screen area.

18

19    **FIG. 3** is a third plan view of a handheld device in accordance with certain  
20    embodiments of the invention, wherein the third plan view illustrates a menu  
21    that provides the user with digital ink options.

22

1 **FIG. 4** is a flow diagram for handling pen down events using a conveyor ink  
2 technique for user input in accordance with certain embodiments of the  
3 invention.

4

5 **FIG. 5** is a flow diagram for handling pen move events using a conveyor ink  
6 technique for user input in accordance with certain embodiments of the  
7 invention.

8

9 **FIG. 6** is a flow diagram for handling pen up events using a conveyor ink  
10 technique for user input in accordance with certain embodiments of the  
11 invention.

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13 **FIG. 7** is a flow diagram for handling pen up timeout events using a conveyor  
14 ink technique for user input in accordance with certain embodiments of the  
15 invention.

16 **FIG. 8** is a system diagram for receiving continuous handwritten input using a  
17 conveyor ink technique for user input in accordance with certain embodiments  
18 of the invention.

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## DETAILED DESCRIPTION OF THE INVENTION

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail specific embodiments, with the understanding that the present disclosure is to be considered as an example of the principles of the invention and not intended to limit the invention to the specific embodiments shown and described. In the description below, like reference numerals are used to describe the same, similar or corresponding parts in the several views of the drawings.

Referring to **FIG. 1** a first plan view of a handheld device 100 in accordance with certain embodiments of the invention showing a graphical handwriting user interface having a continuously scrolling written text input screen area is shown. The handheld device has a graphical handwriting user interface 102 in accordance with certain embodiments of the invention. A lower portion of the display is designated handwriting input area 104 with the area 105 thereabove used for displaying, in a digital ink format, the text that is input in area 104, as well as for other features of the various applications the device incorporates. Action icons 106, 108, 110, 112 and 114 are disposed at a right side of the handwriting user interface 102. Action icons 126 are disposed at a bottom side of handwriting user interface 102. Action icons 106, 108, 110, 112, 114, and action icons 126 may include one or more of a clock, menu toggle button, keyboard display icon, undo icon, backspace icon, spacebar icon, cursor icon, and new line icon. Digital ink text is displayed in the screen area 105 between a file management tool bar 116 and the handwriting input area 104. In this embodiment, a scroll bar 118 is disposed at the right side of the interface display 112. As written text is entered, the

1 entry is displayed contemporaneously in the input area 104 as can be seen in  
2 figure 1. Effectively the user is provided with a writing area that is  
3 continuously moving from right to left. It is noted that the terms "handwriting"  
4 and "handheld" device are generic and as such also apply to situations in  
5 which a user is unable to hold the device or in situations in which handwriting  
6 is not possible, for example in the case a paralysis a user may provide input  
7 using a mouth pen and in the case of a fixed-mounted unit the user may be  
8 required to access the device without direct handling.

9  
10 Word demarcation may be done, simply, by one or more spaces or  
11 other special characters, intentionally or implicitly inserted between a current  
12 word and a next word. In certain embodiments of the present invention, a  
13 vertical word separator line (a word demarcation for signaling the end of one  
14 word and the beginning of a next word) may be selectively displayed.  
15 Provided input continues to the left of the word separator line, the current  
16 word is continued. Otherwise, if input continues to the right of the word  
17 separator line, a word break is indicated and a new word is begun. It is noted  
18 that a position of the word separator is not fixed. In certain embodiments of  
19 the present invention the word separator line is displayed to the right of the  
20 current point, and only when the pen is lifted.

21  
22 As the user writes, the written input trails off to the left on the virtual  
23 ticker tape, as can be seen by referring exemplary handwriting input area 104  
24 of second plan view 200 of **FIG. 2**. Accordingly, as the user is writing the  
25 entries such as those in the illustrated word "happy," the word will be shifted  
26 so that it gradually is removed from the input area 104 as by trailing off, e.g.,  
27 off from the right to the left side. Also, the word separator line 120, if included  
28 and used, likewise trails off to the left edge of the input area 104 and remains  
29 there until entry resumes for the next word, "words" in this example.  
30 Otherwise, if the word separator line 120 is not used/included, the current

1 word may trail off with a next word begun by allowing a sufficient gap between  
2 the current word and the new entry such that the gap could be recognized as  
3 a space. Alternately, a special character or a special space character may be  
4 included to signify a word break. By virtue of each word trailing off and being  
5 removed from the input area, the user is presented with substantially unlimited  
6 writing space in the normally space-constrained input area 104. It is noted  
7 that written input may be removed by trailing off from the right to the left side  
8 or from the left to the right side of input area 104 without departing from the  
9 spirit and scope of the present invention. It is also noted that input area 104  
10 and screen area 105 may be oriented so that a long axis of input area 104 is  
11 vertical thereby accommodating languages in which characters are entered  
12 from top to bottom or bottom to top without departing from the spirit and scope  
13 of the present invention.

14

15 The device 100 may include a communications function and, to that  
16 end in this embodiment, an antenna 122 is shown at the top of the device  
17 100. Individual function switches, buttons and other controls are disposed  
18 about the device, as is deemed appropriate for the particular device. The  
19 device 100 may also include an expansion port 124 or an expansion port  
20 function may be provided wirelessly through antenna 122. In certain  
21 embodiments of the present invention, the device 100 runs under a state of  
22 the art operating system for such handheld devices, e.g. Windows® CE from  
23 Microsoft Corporation, Epoc® from Symbian or the Palm OS® from Palm, Inc.

24

25 The Handwritten Input User Interface (HIUI) of the present invention  
26 may be employed with a handwriting recognition engine capable of  
27 recognizing handwritten text, continuously input using any combination of  
28 writing styles. Alternatively, the HIUI may be employed with an ink only mode  
29 in which the text that is entered into input area 104 is directly displayed, after  
30 appropriate scaling and formatting, as digital ink in screen area 105 without

1 any form of handwriting recognition performed. It is noted that the method of  
2 handling entered text may incorporate one or more of handwriting recognition  
3 or ink only display. The ink only display method may be viewed as a form of  
4 jotting down a note in certain embodiments of the present invention. The user  
5 is not restricted to cursive entry, nor is each entry delineated by a pause or by  
6 a time out between entries. Handwritten input may be provided in cursive  
7 (i.e., contiguous characters in each entry touching or connected), pure print  
8 (i.e., characters in every entry disconnected and not touching), pseudo-print  
9 (at most, pairs of characters in entries touch) or any combination thereof. In  
10 certain embodiments of the present invention, the user is operable to  
11 determine a color, line thickness, and font size of the entered text. These  
12 display preferences may be set, for example, in one or more user interfaces  
13 accessible from the graphical handwriting user interface 102. It is further  
14 noted that certain embodiments of the present invention allow the user to  
15 insert print characters within the written input of the screen area 105 further  
16 comprising activating a keyboard, said keyboard operable to be used to enter  
17 alpha-numeric characters intermingled with the written input.

18

19 The recognition engine includes a main dictionary and may also  
20 include a user dictionary to which the user may add words to supplement the  
21 main dictionary. While using text recognition mode and while in a sentence or  
22 continuous mode, the recognition engine automatically separates or brackets  
23 each word as it is entered, using spaces, special characters or word separator  
24 line to bracket individual separate words. The recognition engine takes each  
25 individual word on the fly, and compares that handwritten input word against  
26 all words contained in the main dictionary and the user dictionary. A  
27 probability score is generated by the recognition engine for each dictionary  
28 word that is indicative of the likelihood that the handwritten entry matches that  
29 particular dictionary word. Based on each word's probability score, a list of  
30 likely matches is collected. When a pen trace falls out of the visible window

1 area, the recognizer is invoked to buffer or recognize the ink. That is, the  
2 recognizer may, or may not, return a result at that time. At the very end of  
3 writing (say after a time-out), the recognition engine is requested to process  
4 any buffered ink for which no recognition result has been returned.

5  
6 Referring now to **FIG. 3** a third plan view 300 of a handheld device is  
7 shown in accordance with certain embodiments of the invention, wherein the  
8 third plan view illustrates a menu that provides the user with digital ink  
9 options. The third plan view is substantially similar to the first plan view with  
10 the addition of menu 310. Menu 310 may be used while in ink only mode to  
11 perform one or more operations on the digital ink. It is noted that these  
12 operations may include one or more of: sending the digital ink electronically  
13 to a remote destination, printing the digital ink, erasing the digital ink from the  
14 screen area 105, viewing the digital ink at a greater or lesser degree of  
15 resolution, or applying the recognition engine to the digital ink. The user may  
16 apply the stylus to the menu 310 to make a choice from the menu 310. In  
17 certain embodiments of the present invention, the display of menu 310 may  
18 be selectively toggled using a menu button coupled to the handwriting user  
19 interface 102.

20  
21 Referring now to **FIG. 4** a flow diagram for handling pen down events  
22 400 using a conveyor ink technique for user input is shown in accordance with  
23 certain embodiments of the invention. The flow diagram 400 illustrates how  
24 handheld device 100 operates when the user touches input area 104 with a  
25 stylus. When a penDown event occurs (block 402), handheld device 100 first  
26 determines whether traces are already present in input area 104 (block 402).  
27 If traces are present and these traces have substantially fallen off an edge of

1 input area 104 (yes in block 406), then these ink traces are sent directly to an  
2 ink processor for display in screen area 105 (block 408) and are then deleted  
3 from input area 104 (block 410). If there are no traces present in input area  
4 104 or traces are present but have not yet fallen off the edge of input area 104  
5 (no in block 404 or no in block 406), then the input area is checked for  
6 scrolling (block 412). If input area 104 is not yet scrolling, then scrolling is  
7 started (block 414), and in either case of scrolling or not scrolling any pending  
8 timeouts are canceled (block 416). An ink point is then drawn in the input  
9 area 104 and added to the current trace if there is a current trace. If there is  
10 not a current trace, then a new trace is started (block 418). The timeouts may  
11 be used to detect a presence or absence of activity in input area 104 to stop  
12 scrolling. In certain embodiments of the present invention, the user may  
13 control the duration of the timeouts.

14

15 Referring now to **FIG. 5** a flow diagram for handling pen move events  
16 500 using a conveyor ink technique for user input is shown in accordance with  
17 certain embodiments of the invention. On receiving a penMove event (block  
18 502), an ink point is added to input area 104 (block 504) and to the current  
19 trace.

20

21 Referring now to **FIG. 6** a flow diagram for handling pen up events 600  
22 using a conveyor ink technique for user input is shown in accordance with

1 certain embodiments of the invention. On receiving a penUp event (block  
2 602), an ink point is added to input area 104 (block 604) and to the current  
3 trace. This terminates the current trace. A penUpTimeout event 606 is then  
4 scheduled as in block 606. The penUpTimeout can then be used to  
5 determine how handheld device 100 processes a lack of activity in input area  
6 104. The penUpTimeout may be reset when stylus activity is recorded in  
7 input area 104 as in the penDown event of **FIG. 4**.

8

9 Referring now to **FIG. 7** a flow diagram for handling penUpTimeout  
10 events 700 using a conveyor ink technique for user input is shown in  
11 accordance with certain embodiments of the invention. When a  
12 penUpTimeout event becomes active (block 702), indicating a specified  
13 amount of time has passed since any occurrence of user activity in input area  
14 104, any pending timeouts are canceled (block 704) and ink traces present in  
15 input area 104 are sent to an ink processor for display in the screen area 105  
16 (block 706). In certain embodiments of the present invention, a length of  
17 penUp Timeouts may be set by the user. The ink traces are then deleted  
18 from input area 104 (block 708), and scrolling of input area 104 is stopped  
19 (block 710).

20

21 Referring now to **FIG. 8** a system diagram 800 for receiving continuous  
22 handwritten input using a conveyor ink technique for user input is shown in

1 accordance with certain embodiments of the invention. The system diagram  
2 800 illustrates how stylus motion events represented as penDown, penUp,  
3 PenMove, and PenUpTimeout events are handled from a functional point of  
4 view by handheld device 100.

5

6 The Conveyor Ink user interface 830 is a handwriting input user  
7 interface for continuous text input within a very small writing space, such as  
8 small portable devices with a touch-enabled screen. The Conveyor Ink user  
9 interface 830 includes an input area 104 on the device 100 that behaves as a  
10 conveyor such that electronic ink input is immediately moved from right to left  
11 while it is being entered, giving the user the feeling of writing text on a virtual  
12 ticker-tape. This allows the user to write continuously and indefinitely with  
13 minimal hand movement and writing space. The user is able to write  
14 continuously and indefinitely without the interruption of clearing or scrolling the  
15 input area 104, thereby increasing the text input speed of the user. It is noted  
16 that in certain embodiments of the present invention, a rate of scrolling of  
17 input area 104 may be set by the user. The rate of scrolling may be set so  
18 that users with differing rates of text input can write continuously in input area  
19 104. It is further noted that in certain embodiments of the present invention, a  
20 user may opt to draw without having the input area scroll. This may be  
21 accomplished, for example, by the user entering a pause mode by pressing a  
22 user interface button, wherein said pause mode is operable to prevent input

1 area 104 from scrolling. The user can then draw within input area 104, and  
2 after the user finishes drawing, exiting the pause mode whereby what was  
3 drawn is placed in the screen area 105. The ability to pause the scrolling of  
4 input area 104 may be useful, for example, when the user wishes to draw a  
5 picture, figure, equation, or even enter text more legibly.

6

7 In a traditional pen-and-paper experience, users handwrite by moving  
8 the hand and arm across the writing surface. For example, Latin based text  
9 input requires the user to move the hand from left to right, and from top to  
10 bottom if necessary, across the writing surface. With the conveyor ink, the  
11 user's arm does not move, but instead the writing surface scrolls the  
12 appropriate direction, such as from right to left for Latin based text input.  
13 Thus, the user never runs out of writing space.

14

15 The Conveyor Ink user interface 830 utilizes two non-blocking  
16 cooperating processes, an ink collection process and an ink processing  
17 process, to handle and process user input. The ink collection process is  
18 responsible for user input in input area 104 while the ink processing process  
19 is responsible for recognition or conversion to ink-text and the display of text  
20 in screen area 105 in ink only mode. While the collection process is collecting  
21 ink traces and without interruption the collected ink is regularly passed from  
22 the collection process to the ink processing process for recognition and

1 display in screen area 105 or for display as digital ink in screen area 105.

2

3 How often ink is passed for ink processing reflects a compromise  
4 between two conflicting goals: returning results to the user as often as  
5 possible and buffering enough ink together to make processing meaningful  
6 (e.g., recognition of a single ink point might not make much sense). In certain  
7 embodiments of the present invention, a criterion is to pass pen traces to the  
8 ink processor as they fall out of the visible writing area. A trace is a sequence  
9 of ink points bounded by pen-up points.

10

11 The core functionality of the collection process of scrolling and  
12 collecting ink traces is handled in ConveyorArea 820. The ConveyorArea 820  
13 handles the collection and display of ink traces in a conveyor canvas 834.

14

15 The core functionality of the ink processing process of converting input  
16 ink traces into ink-text is handled in InkTextArea 810. The InkTextArea 810  
17 handles the scaling and segmentation of the handwritten ink for display as  
18 ink-text in screen area 105. The InkTextArea 810 is coupled with the  
19 ConveyorArea 820 to allow users to write big, without interruption, in the  
20 automatically scrolling input conveyor canvas 834, and read small, and  
21 possibly edit, in the ink-text canvas 832.

22

23 Conveyor ink user interface 830 of handheld device 100 comprises an

1 ink text canvas 832 and conveyor canvas 834. Conveyor canvas 834  
2 registers events with event loop 836 and event loop 836 interacts with  
3 conveyor area 820 in order to control display of text to input area 104.  
4 Conveyor area 820 and one or more ink traces 824 operable to be coupled to  
5 conveyor area 820 interact with InkTextArea 810 to display ink traces 824 in  
6 ink Text Canvas 832. Ink Text Canvas 832 is coupled to screen area 105.  
7 Ink traces 824 and conveyor area 820 interact with input area 104 to display  
8 results of stylus motion events in input area 104.

9  
10 Note that InkTextArea 810 is operable to send 812 and receive 872  
11 actions to conveyor area 820. Such actions may include size and positioning  
12 of displayed text in screen area 105, as well as text recognition functions,  
13 which may be performed in text in screen area 105 as for example under  
14 menu 310.

15  
16 It is noted that in certain embodiments of the present invention, the  
17 InkTextArea object 810 might not be able to draw the digital ink directly. An  
18 inter-process communication framework, available in the implementation  
19 platform of choice, will dictate whether or not this is possible. As a first  
20 example, in an environment supporting a "lightweight" process model, the  
21 ConveyorArea 820 and the InkTextArea 810 can be separate threads of a  
22 process with shared memory between them. In this case, the Conveyor

1 canvas 834 and the ink-text canvas 832 can be subwindows of a same parent  
2 window. This is operable to enable the InkTextArea object 810 to draw the  
3 digital ink directly.

4

5 As a second example, in a “heavyweight” process model, there is no  
6 shared memory with other processes and there is only one thread in each  
7 process. In this case the InkTextArea object 810 would need to send back  
8 the digital ink to the process containing the ConveyorArea 820 and have the  
9 display of the digital ink handled there.

10

11 In certain embodiments of the present invention, conversion of written  
12 input to digital ink involves two steps: scaling and segmenting the written input  
13 into lines so that it can be displayed vertically. In certain embodiments, traces,  
14 which after scaling are wider than the canvas width, are broken into sub-  
15 traces. Single point traces may be augmented with one or more dummy points  
16 to facilitate drawing. Note that in certain embodiments of the present  
17 invention, this segmentation is done without analysis of the gaps between  
18 traces for possible word boundary identification.

19

20 The event loop 836 handles, but is not limited to, one or more of  
21 onPenDown 838, OnPenMove 840, OnPenUp 842, and PenTimeout 844  
22 events. As an example, depending upon the capabilities of handheld device

1 100, event loop may also respond to pen down events in specific geographic  
2 regions of input area 104, or may respond to multiple taps of a stylus in input  
3 area 104 with customized behavior without departing from the spirit and scope  
4 of the present invention. This customized behavior may include performing  
5 text recognition on input text, or may include any of the features of menu 310.  
6 It is also noted that in certain embodiments of the present invention, event  
7 loop may respond to actions that include varying a force with which the stylus  
8 is in contact with input area 104.

9  
10 It is also noted that in certain embodiments of the present invention, a  
11 capability may be present in which handheld device 100 is operable to toggle  
12 between ink only mode characterized by the flow diagrams of FIG. 4-7 and  
13 text recognition mode. Such a toggle operation may be activated from one or  
14 more of menu 116, menu 310 or additional events within input area 104 such  
15 as double tapping input area 104 with a stylus. This toggling may be usable  
16 for example, in signing a note or letter to provide a certain amount of  
17 authentication or in providing a rough drawing of an object. It is also noted  
18 that in certain embodiments of the present invention, the user can place a  
19 cursor for digital ink modification in the display area. The digital ink  
20 modification or editing may comprise one or more of deleting one or more  
21 portions of ink traces of the digital ink, inserting one or more spaces between  
22 ink traces of the digital ink, inserting one or more new lines within the ink  
23 traces of the digital ink, or removing one or more spaces between ink traces  
24 of the digital ink. If the user wishes to delete one or more portions of the ink  
25 traces, then the user may place a cursor for digital ink modification in the  
26 display area and delete a portion of an ink trace using a delete key. If the  
27 user wishes to insert one or more spaces within the ink traces, then the user

1 may place a cursor for digital ink modification in the display area and insert  
2 one or more spaces within an ink trace using an insert key. Similarly, a user  
3 can remove one or more spaces between ink traces by placing a cursor for  
4 digital ink modification in the display area between two ink traces and deleting  
5 a portion of a gap between the two ink traces using a delete key.

6

7 While the invention has been described in conjunction with specific  
8 embodiments, it is evident that many alternatives, modifications, permutations  
9 and variations will become apparent to those of ordinary skill in the art in light  
10 of the foregoing description. Accordingly, it is intended that the present  
11 invention embrace all such alternatives, modifications and variations as fall  
12 within the scope of the appended claims.

13

14 What is claimed is:

15